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A NEW GENUS OF NORTH AMERICAN SCORPIONS WITH A KEY TO THE NORTH AMERICAN GENERA OF VAEJOVIDAE (SCORPIONIDA: VAEJOVIDAE)

By

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ABSTRACT: A new genus of North American vaejovid scorpions is described and named *Nullibrotheas*. *Nullibrotheas* is a monotypic genus, the only species being *Nullibrotheas allenii* (Wood). The systematic relationships of *N. allenii* are analyzed and it is concluded that the closest known relatives are in the vaejovid genera *Uroctonus* and *Vaejovis*. A key to the North American genera of Vaejovidae is included.

INTRODUCTION

In 1863, Horatio Wood described a new species of North American scorpion which he named "*Scorpius allenii*" (Wood, 1863a). This new taxon was based on specimens collected by L. J. Xantus de Vesey from Cabo San Lucas, in Baja California, Mexico, presumably between 1859 and 1861. This new species had the distinction of being one of the first species of North American scorpions to be described and named, and it has remained one of the most misunderstood taxa in North America. The actual identity and phylogenetic relationships of this species remained unknown until just recently.

The main purposes of this study are to more clearly define the species '*allenii*,' to determine its geographical distribution, to study its systematic affinities, and to erect a new genus to permit appropriate taxonomic placement of '*allenii*.' Most of the specimens cited as new records are deposited in the collections of the California Academy of Sciences.

Acknowledgments

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Nullibrotheas Williams, new genus

Type-species: *Scorpius allenii* Wood, 1863.

Description. Pedipalp palms greatly swollen, fingers shorter than palm or carapace; brachium with posterior border of inferior surface with six long trichobothria; fingers with supernumerary denticles flanking single principal row of denticles medially. Pectines with fulcra sub-triangular in shape; middle lamellae with elongate basal piece and one row of subcircular to ovate sclerites; males with longer comb, longer teeth, and greater number of teeth than females. Males with large distinct genital papillae on inner margins of genital operculum. Sternum pentagonal, with almost parallel sides; length approximates width or is slightly longer. Stigma of book lungs minute, circular in shape. Last tarsomere of walking legs with one row of short spines on ventral surface; two pedal spurs. Two median eyes on low ocular tubercule; median eyes entirely on anterior half of carapace; lateral eyes three per group, third eye reduced to degenerate, often giving appearance of two-eyed condition.

Nullibrotheas allenii (Wood).

(Figures 1–4; table 1.)

Scorpius allenii Wood, 1863a, p. 360 (original description); 1863b, p. 107.
Broteas allenii, Marx, 1887, p. 91.
Uroctonus privus Karsch, 1879, p. 103 (original description); Hjelle, 1972, p. 28–29.

Table 1. Measurements (in millimeters) of *Nullibrotheas allenii* Wood, SCW #116 (1), topotypes from Cabo San Lucas, Baja California Sur, Mexico.

	Male	Female
Total length	42	30
Carapace, length	5.0	4.5
width (at median eyes)	4.1	3.7
Metasoma, length		
segment I (length/width)	2.2/3.1	1.5/2.4
segment II (length/width)	2.6/2.7	1.9/2.2
segment III (length/width)	2.9/2.6	2.0/2.0
segment IV (length/width)	3.5/2.4	2.6/1.8
segment V (length/width)	5.7/2.3	4.3/1.8
Telson length	6.0	4.2
Vesicle (length/width)	4.4/2.4	2.8/1.8
depth	2.0	1.4
Aculeus, length	1.6	1.4
Pedipalp		
Humerus (length/width)	3.4/1.7	3.0/1.4
Brachium (length/width)	3.9/1.6	3.5/1.4
Chela (length/width)	7.7/2.7	6.7/2.5
depth	4.8	3.6
movable finger, length	4.3	3.5
fixed finger, length	2.4	2.2
Pectines, teeth (left/right)	11/11	8/9
Sternum (length/width)	1.1/1.1	1.1/1.2
Stigma (circular), diameter	0.2	0.2
Number middle lamellae	6	5
Genital operculum (length/width)	0.8/1.6	0.6/1.7

Uroctonus mordax (part), Kraepelin, 1894, p. 194 (synonymy of *U. privus*).

Broteas formosus Marx, 1889, p. 211.

Broteas alleni, Ewing, 1928, pp. 3, 6 (part); Hoffmann, 1931, pp. 332–333; Kraepelin, 1899, p. 176 (lists as doubtful species of chactid); Gertsch, 1958, pp. 2–5; Gertsch and Soleglad, 1966, p. 1; Diaz Najera, 1970, pp. 113–114.

Broteochactas allenii (part), Banks, 1910, p. 188.

Type data. *Scorpius allenii* Wood, two cotypes (one male, one female); collected at Cabo San Lucas, Baja California Sur, Mexico; male cotype deposited in U. S. National Museum (Type number S-5, jar 2), the location of the female cotype is unknown. The male cotype is intact, badly yellowed, and not well preserved. This specimen was designated as a lectotype by Gertsch (1958). It appears to be a subadult.

The type of *Uroctonus privus* Karsch is a holotype female with the following

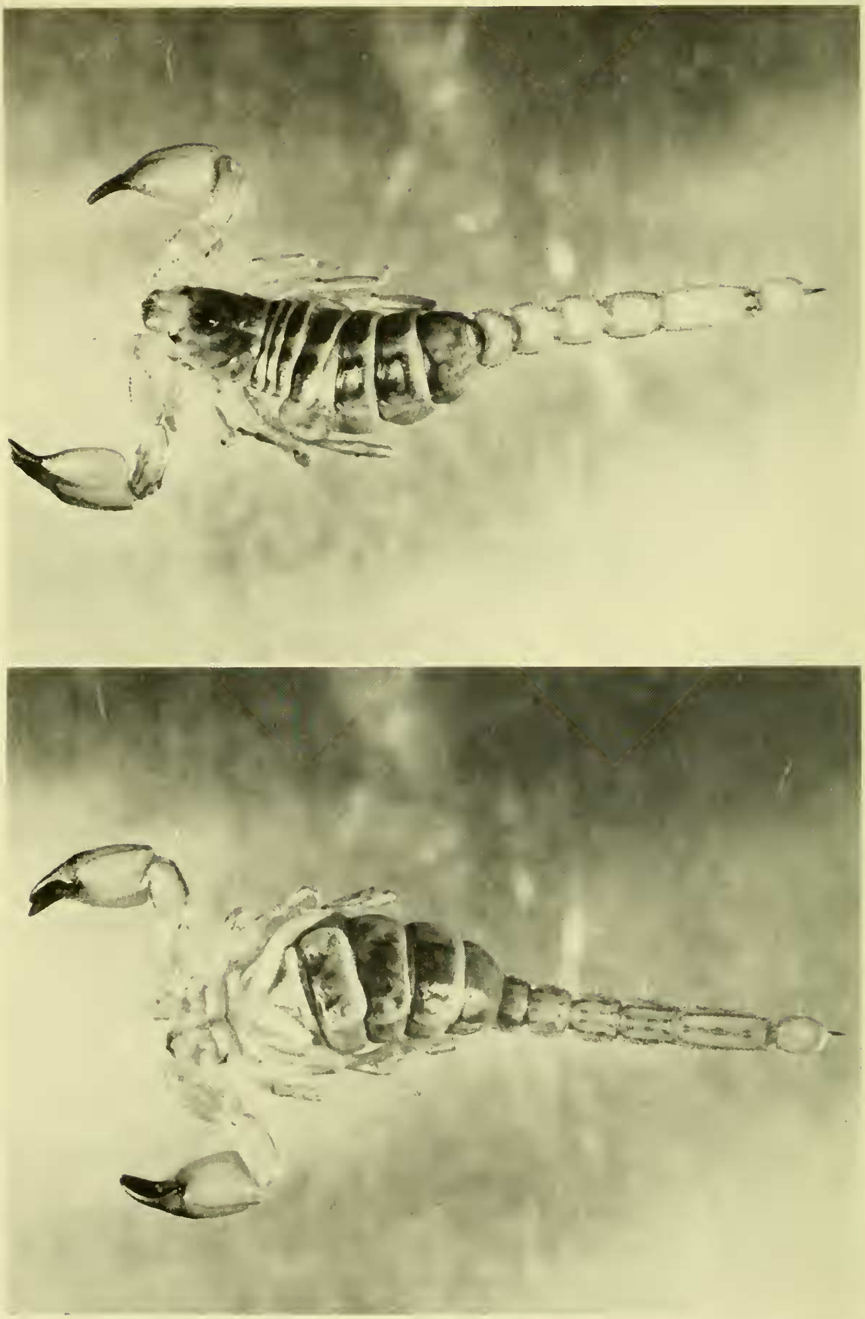

Figure 1. *Nullibrotheas allenii* (Wood), dorsal and ventral views of male topotype from Cabo San Lucas, Baja California Sur, Mexico.

data attached "Californien; leg. graber." It is deposited in the Zoological Museum of Berlin, DDR; catalog number 3036. The holotype is a small juvenile that does not differ significantly from the juveniles of *N. allenii* collected recently in the Cape region of Baja California, Mexico. The holotype is somewhat faded with age but the color pattern is still apparent; the metasoma is severed between segments 2 and 3.

Redescription based on topotypes from Cabo San Lucas. Variable species throughout range in coloration, cuticular granulation, hirsuteness, and body size; apparently forming many more or less isolated regional races. Typically with base color of cuticle golden yellow with underlying dusky to dark markings on carapace and mesosomal dorsum; pedipalps with dark reddish brown fingers; metasoma with inferior keels with more or less distinct dusky stripes; other parts of cuticle may or may not show underlying dusky markings.

Carapace. Anterior margin usually with deep median emargination and rounded lateral ends; lateral eyes generally three per group (sometimes apparently two per group); median eyes two in number, located on elevated ocular tubercule; median diad completely on anterior half of carapace. Sternum large, pentagonal; lateral sides almost parallel; length approximates width or is slightly longer; with deep median longitudinal furrow along posterior half.

Mesosoma. Terga 1 to 6 usually lustrous; seventh tergum with one pair short, obsolescent lateral keels, these granular; terga 1 to 6 lacking distinctly developed dorsal keels; sterna smooth and lustrous; stigma small, circular in shape; all sterna lack keels.

Metasoma. Dorsal and dorsolateral keels present and granular on segments I to IV; inferior lateral keels smooth to crenulate on I, irregularly crenulate on II and III, serrate on IV and V. Inferior median keels smooth to obsolescent on I, crenulate to obsolescent on II, crenular on III, serrate on IV and V.

Telson. Aculeus short, less than one-half length of vesicle; larger individuals normally with laterally swollen vesicle.

Pectines. Male with middle lamellae consisting of elongate basal piece and about five or six subcircular to ovate sclerites in single row; fulcra subtriangular; pectinal teeth six to nine in females, 10 to 14 in males; female comb much smaller than male, proximal one-fourth of female comb lacking teeth.

Genital operculum. In males completely divided longitudinally; in females divided only in posterior region of furrow; males with very large, conspicuous genital papillae, these lacking in females.

Chelicerae. Fixed finger with one simple tooth and one greatly elevated bicuspid tooth; movable finger with superior border armed with three or four simple teeth in addition to terminus; inferior border with three or four small denticles, these not conspicuous.

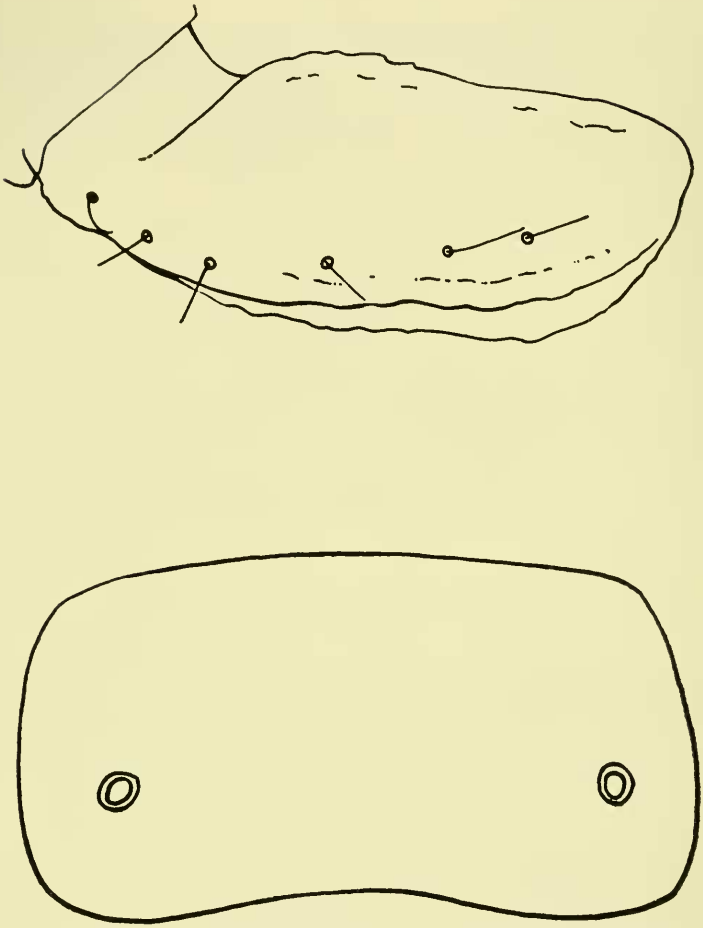

Figure 2. *Nullibrotheas allenii* (Wood) figured from topotype male from Cabo San Lucas, Baja California Sur, Mexico. Top. Ventral view of pedipalp brachium. Bottom. Mesosomal sternum showing openings to book lungs.

Pedipalps. Fingers very short, palm very deep and swollen; keels obsolete to smooth except for pronounced inferior keel; palm surface lustrous, smooth to finely granular. Movable finger distinctly shorter than carapace; fixed finger shorter than metasomal segment III. Each finger armed with one longitudinal row of small denticles; no distinct gap between fingers when chela closed. Fingers very hirsute. Brachium with six trichobothria on posterior border of inferior surface.

Walking legs. Two pedal spurs; one row of minute, longitudinally arranged hairs on ventral surface of last tarsomere.

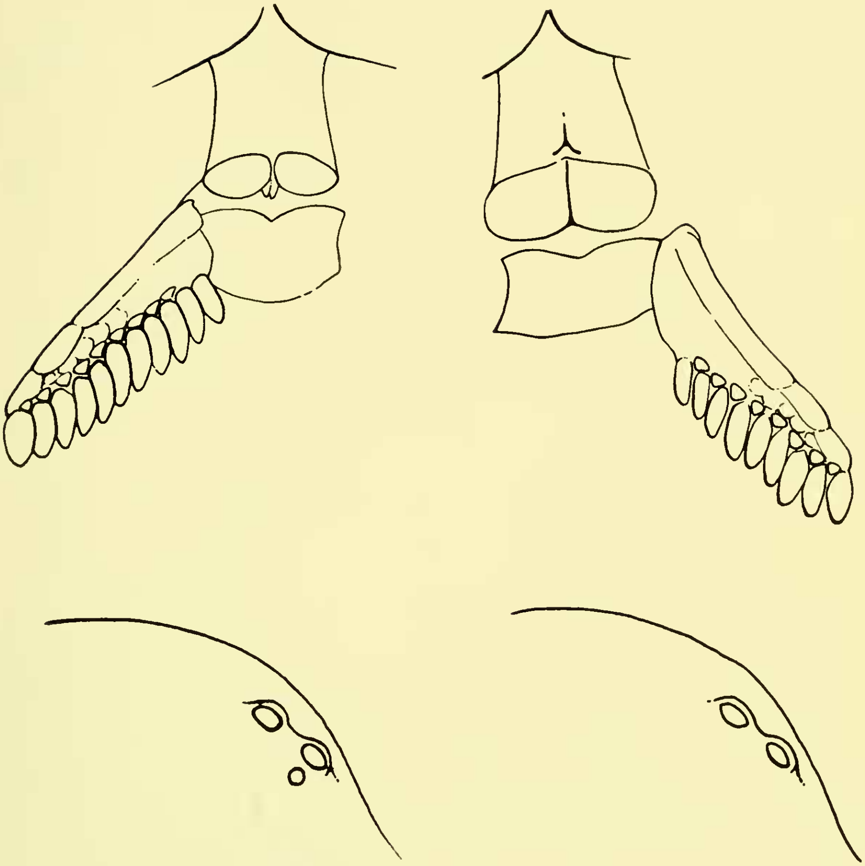

FIGURE 3. *Nullibrotheas allenii* (Wood), figured from topotypes from Cabo San Lucas, Baja California Sur, Mexico. Top left. Ventral view of male showing prosomal sternum, genital opercula, and pectines. Top right. Ventral view of female showing prosomal sternum, genital opercula, and pectines. Bottom left. Right anterolateral aspect of carapace showing three lateral eyes. Bottom right. Right anterolateral aspect of carapace showing two lateral eyes.

GEOGRAPHICAL DISTRIBUTION. Known only from the southern region of the Baja California peninsula and associated islands. Specimens have been collected from Cabo San Lucas north to El Coyote on Bahia Concepcion. Reports of this species in the United States appear to be due to errors in locality records and to mistaken identification of this species.

New records. Known from the following localities in Baja California Sur, Mexico: 1 mi. SW. Rancho Canipole, elevation 800 ft., 16 May 1969, (S. C. Williams), 2 juveniles; 4 mi. SW. San Miguel de Comondu, elevation 900 ft., 15 May 1969, (S. C. Williams), 2 juveniles; 5 mi. SW. San Miguel de Comondu,

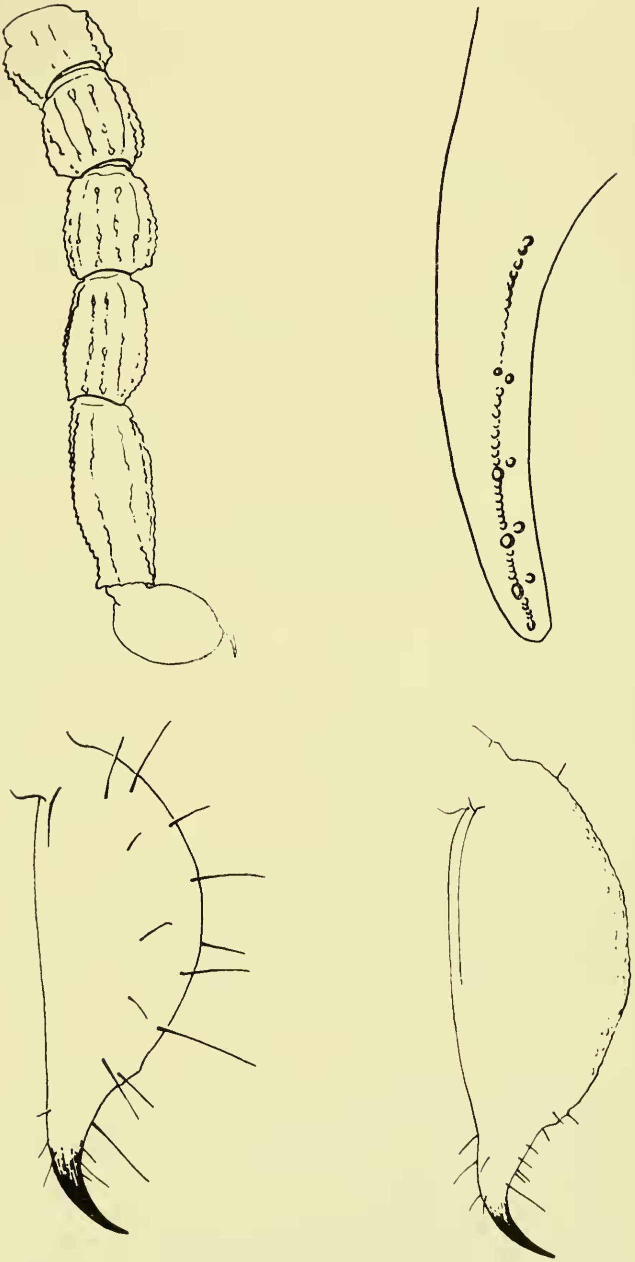

Figure 4. *Nullibrotheas allenii* (Wood), figured from topotypes from Cabo San Lucas, Baja California Sur, Mexico. Top left. Ventral view of male metasoma. Top right. Movable pedipalp finger of male. Bottom left. Female telson. Bottom right. Male telson.

elevation 1000 ft., 2 July 1968, (S. C. Williams, M. A. Cazier), 1 male, 1 female, 1 juvenile; 5 to 10 mi. SW. San Miguel de Comondu, elevation 1000 ft., 3 July 1968, (S. C. Williams, M. A. Cazier), 1 female, 3 juveniles; San Jose de Comondu, 15 February 1966, (V. Roth), 1 male, 1 female; 4 mi. W. La Purisima, elevation 375 ft., 1 July 1968, (S. C. Williams, M. A. Cazier), 1 female; Rancho Las Parras, 26 May 1970, (S. C. Williams, V. F. Lee), 1 juvenile; 9.9 mi. N. Loreto, 27 May 1970, (S. C. Williams, V. F. Lee), 1 juvenile; Loreto city dump, just N. Loreto, 20 June 1964, (Chris Parrish), 1 female; 8 mi. S. Loreto, base of La Gigantia, 27 January 1965, (V. Roth), 1 male juvenile; Puerto Escondido, 17 mi. S. Loreto, 27 May 1970, (S. C. Williams, V. F. Lee), 1 juvenile; 22 mi. NE. Santo Domingo, 15 February 1966, (V. Roth), 1 female, 1 juvenile; 51 mi. N. El Crucero, elevation 400 ft., 14 May 1969, (S. C. Williams), 1 male, 3 females, 7 juveniles; 10 mi. N. El Crucero, 15 February 1966, (V. Roth), 1 male juvenile, 1 female juvenile; Bahia Concepcion near El Coyote, 26.40 N., 111.50 W., 17 February 1966, (V. Roth), 3 males; 10.3 mi. SE. Santa Rita, 27 July 1968, (S. C. Williams, M. A. Cazier), 1 male, 1 female, 1 juvenile; 49.3 mi. SE. Santa Rita, 27 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 49.3 mi. SE. Santa Rita, 27 July 1968, (S. C. Williams, M. A. Cazier), 1 male, 4 juveniles; 31.0 mi. W. Los Aripes, elevation 800 ft., 25 July 1968, (S. C. Williams, M. A. Cazier), 3 juveniles; 1 mi. E. Los Aripes, 8 July 1968, (S. C. Williams, M. A. Cazier), 1 male; 1.4 mi. W. El Coyote, 30 December 1958, (H. B. Leech), 1 male, 3 juveniles; La Paz, 1 to 3 February 1965, (V. Roth), 1 female, 3 juveniles; 2 mi. E. La Paz, elevation 50 ft., 5 July 1968, (S. C. Williams, M. A. Cazier), 1 male; 12.4 mi. E. La Paz on road to Las Cruces, Arroyo Agua de los Pozos, 4 January 1959 (A. Leviton), 1 juvenile; 2 mi. NW. Los Pozos, 23 July 1968, (S. C. Williams, M. Bentzien, W. Fox), 8 juveniles; 14.5 mi. E. La Paz on road to Las Cruces, 4 January 1959, (H. B. Leech), 1 juvenile; .25 mi. N. La Paz airport, 12 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 6 mi. N. La Paz on road to Pichilingue, 6 January 1959, (H. B. Leech), 1 juvenile; 12.5 mi. N. La Paz on road to Pichilingue, 29 December 1958, (H. B. Leech), 1 female; Puerto Balandra, approximately 13 mi. N. La Paz, 3 September 1963, (P. R. & D. L. Craig), 1 juvenile female; 14 mi. NE. La Paz along A. Balandra road, 14 July 1968, (S. C. Williams, M. A. Cazier), 2 males, 1 female, 1 juvenile; 14 mi. NE. La Paz along A. Balandra road, 9 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 75 mi. NW. La Paz, elevation 200 ft., 4 July 1968, (S. C. Williams, M. A. Cazier), 1 female; 5 mi. SW. La Paz, 2 August 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; Las Cruces, 5.0 mi. SW. Las Cruces, 30 July 1968, (S. C. Williams, M. A. Cazier), 2 females, 5 males, 4 juveniles; 5 to 6 mi. SW. La Paz, elevation 25 ft., 5 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 14.8 mi. N. Todos Santos, elevation 500 ft., 24 July 1968,

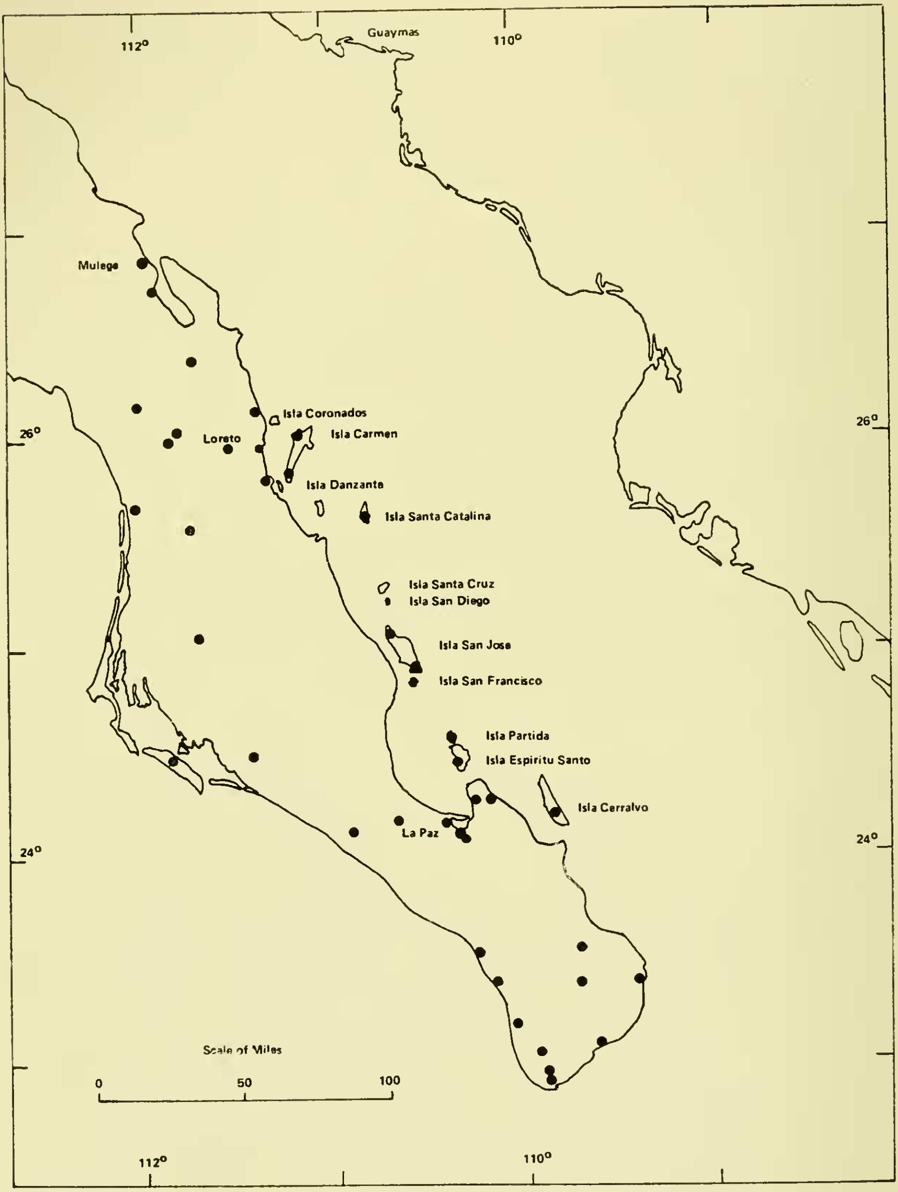

FIGURE 5. Distribution of *Nullibrotheas allenii* (Wood) in Baja California Sur, Mexico.

(S. C. Williams, M. A. Cazier), 1 female, 6 juveniles; 5.5 mi. NW. Todos Santos, road to La Pastora, 13 January 1959, (H. B. Leech), 1 juvenile; 5.9 mi. N. Todos Santos, elevation 500 ft., 24 July 1968, (S. C. Williams, M. A. Cazier), 14 males, 18 females; 9 mi. N. Todos Santos, elevation 200 ft., 4 May 1969, (S. C. Williams), 1 female; 3.5 mi. S. El Pescadero, elevation 20 ft., 23 July 1968, (S. C. Williams, M. A. Cazier), 1 male, 1 female, 4 juveniles; 4 mi. N. Tinaja, 23 July 1968, (S. C. Williams, M. Bentzien, W. Fox), 1 female, 1 juvenile; Santiago, 19 August 1964, (H. W. Campbell), 1 male, 1 female; Boca de la Sierra, near Miraflores, 10 February 1966, (V. Roth), 1 female; Bahia de los Frailes, 9 March 1947, (I. La Rivers), 1 male; 1.5 mi. NE. Punta Palmilla, elevation 50 ft., 16 July 1968, (S. C. Williams, M. A. Cazier), 4 males, 13 females; 1.5 mi. NE. Punta Palmilla, elevation 50 ft., 17 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 2.2 mi. SW. Punta Palmilla, 17 July 1968, (S. C. Williams, M. A. Cazier), 3 juveniles; 3.5 mi. SW. Punta Palmilla, 17 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 3.9 mi. SW. Punta Palmilla, 17 July 1968, (S. C. Williams, M. A. Cazier), 4 males, 6 females; 16.5 mi. NW. Cabo San Lucas, 23 July 1968, (S. C. Williams, M. Bentzien, W. Fox), 5 juveniles; 5 mi. N. Cabo San Lucas, 21 July 1968, (S. C. Williams, M. A. Cazier), 1 juvenile; 4 mi. N. Cabo San Lucas, 21 July 1968, (S. C. Williams, M. A. Cazier), 2 females, 1 juvenile; 2 mi. N. Cabo San Lucas, 19 July 1968, (S. C. Williams, M. A. Cazier), 1 male, 1 female, 1 juvenile; 3 mi. E. Cabo San Lucas, 18 July 1968, (S. C. Williams, M. A. Cazier), 2 females; Cabo San Lucas, 20 July 1968, (S. C. Williams, M. A. Cazier), 3 males, 9 females, topotypes; Isla Carmen, Puerto Ballandra, 24 May 1970, (S. C. Williams, V. F. Lee), 2 juveniles; Isla Carmen, Puerto Ballandra, 23 March 1971, (V. F. Lee), 1 female, 1 juvenile; Isla Carmen, Marquer Bar, 22 June 1964, (R. C. Banks), 1 juvenile; Isla Santa Catalina, 27 April 1964, (C. H. Croulet), 3 females, 6 juveniles; Isla Santa Catalina, NE. side, 10 April 1962, (Members Belvedere Expedition), 1 female, 1 juvenile; Isla Santa Catalina, NW. end, Punta Arena, 24 June 1964, (C. Parrish), 1 male; Isla Santa Catalina, cave on S. end, 25 June 1964, (R. C. Banks), 1 juvenile; Isla Santa Catalina, SW. end, 26 April 1964, (A. J. Sloan), 1 male, 1 female, 4 juveniles; Isla Santa Catalina, W. side, 9 April 1962, (Members Belvedere Expedition), 5 juveniles; Isla Coyote, 19 April 1962, (George Lindsay), 1 female, 2 juveniles; Isla San Diego, WNW. side, 18 April 1962, (C. Parrish, M. Soule), 1 female; Isla San Diego, 19 April 1962, (George Lindsay), 1 juvenile; Isla San Jose, N. side, 26 March 1971, (V. F. Lee), 3 juveniles; Isla San Jose, NE. side of Arroyo de Aguada, 11 April 1962, (Members Belvedere Expedition), 1 female, 3 juveniles; Isla San Jose, S. end near lagoon mouth, 27 June 1964, (C. Parrish), 1 juvenile; Isla San Jose, SW. end, near cattle ranch, 24 April 1964, (A. J. Sloan), 2 females; Isla San Jose, Los Ostiones, 12 April 1962, (Members Belvedere Expedition), 2 females, 1 juvenile; Isla Cayo, 28 June 1964, (C. Parrish, G. Lindsay,

I. Wiggins), 1 male, 2 females, 2 juveniles; Isla San Francisco, SW. side, 25 May 1969, (S. C. Williams), 1 juvenile; Isla San Francisco, S. end, 17 April 1962, (R. C. Banks), 1 male; Isleta Rock, N. Partida Island, 20 April 1962, (M. Soule), 1 male, 1 juvenile; Isla Partida, central valley, elevation 25 ft., 9 July 1968, (S. C. Williams, M. Bentzien, W. Fox), 1 male, 2 juveniles; Isla Partida, dry lake, 29 June 1964, (I. Wiggins), 1 female; Isla Ballena, 21 April 1962, (C. Parrish), 3 juveniles; Isla Espiritu Santo, SW. shore, 7 July 1968, (S. C. Williams, M. A. Cazier), 1 male, 2 females, 10 juveniles, 1 female with 23 in litter; Isla Espiritu Santo, Bahia San Gabriel, 24 May 1969, (S. C. Williams), 5 juveniles; Isla Espiritu Santo, Bahia Canon, 29 June 1964, (I. Wiggins), 2 juveniles; Isla Espiritu Santo, Bahia Candelaro, 30 June 1964, (I. Wiggins), 1 juvenile; Isla Cerralvo, Piedras Gordas, 17 May 1970, (S. C. Williams, V. F. Lee), 5 juveniles; Isla Cerralvo, sand dune area on SW. side, 16 April 1962, (C. Parrish), 1 juvenile; Isla Cerralvo, Arroyo Aguaje, 15 April 1962, (G. Lindsay), 2 juveniles; Isla Cerralvo, Rancho Ruffo, 16 April 1962, (I. Wiggins, G. Lindsay), 1 juvenile; Isla Magdalena, Puerto Magdalena, 17 March 1957, (R. Zweifel), 1 male; Santa Margarita Island, June 1970, (USNM), 1 specimen.

Remarks. *Nullibrotheas allenii* is an extremely variable species in coloration, cuticular granulation, hirsuteness of metasoma and telson, and body size. Throughout its distribution it appears to form series of local races with some evidence of genetic continuity between many of the races. For this reason it appears best to treat this as one variable species rather than as a complex of many poorly defineable, separate ones.

In regard to size, adults in most populations range from 30 to 45 millimeters in length. A few local populations have been found in which adults have attained much larger sizes, in the range of 50 to 60 millimeters. Such giant races have been found in the area of La Paz and on some of the islands of the gulf, notably on Isla Catalina.

In regard to color, most populations have a golden yellow base color with underlying dark coloration on the carapace and mesosomal dorsum. Some populations have the dark markings reduced to faint dusky markings, notably on the Magdalena Plain, while others may have these markings very dense and dark, notably in the volcanic habitats, such as around Comondu. South of Todos Santos the dark coloration of the mesosomal dorsum is divided longitudinally by a thin unpigmented stripe thus creating the appearance of one pair of dark longitudinal stripes. North of the Todos Santos area the metasomal dorsum is usually completely pigmented giving no indication of stripes. Around the Todos Santos and Las Cruces areas individuals are variable and show all forms of intermediate conditions.

The granulation of the cuticle, especially on the carapace, vesicle, and pedipalp palms is highly variable and difficult to interpret. It appears that the amount of granulation is determined by age, sex, length of time since last moult, and individual genetics. Most individuals with more distinctive granulation are larger than average.

The hirsuteness of the vesicle and metasoma is another variable character. In the Cabo San Lucas area the metasoma and telson are usually only moderately hirsute. The northern and island populations generally had both vesicle and metasomal segments IV and V considerably more hirsute than the southern populations. Samples taken from intermediate areas indicate the variation in hirsuteness is to some extent individual, and developmental, and over the range is somewhat clinal.

The collection records of this species indicate that individuals probably spend most of their life cycle in burrows in the ground. They do, however, appear to leave the burrow and seek shelter under suitable surface rocks during part of the year.

Of the hundreds of specimens collected during this study only two females were observed with litters on their backs. Both of these were discovered under the protection of moderate-size flat rocks during July. The females appear normally not to leave their protective shelters at time of birth or while carrying young on their backs. Both females had only small to moderate numbers of young in their litters. The first litter was found 4 miles N. of Tinaja on 23 July 1968 and consisted of the mother and 8 young. The second litter was found on Isla Espiritu Santo on 7 July 1968 and consisted of the mother and 23 young.

During the summer of 1970 the male cotype in the U. S. National Museum was examined and compared with topotypes recently collected at Cabo San Lucas. The type was almost identical to a sub-adult male topotype except for being more yellowish, less hirsute, and lacking the characteristic color pattern (three characteristics commonly altered in this way by poor preservation and age). It was interesting that the cotype was labeled "*Broteas alleni* Wood" by an old hand-written label included in the specimen jar. This was apparently a later addition or alteration of the original data since this species was originally named *Scorpius allenii*. It is notable that when Gertsch (1958) studied and redescribed the types two cotypes were present. In 1970 only one of the cotypes could be located, this presumably is the lectotype designated by Gertsch in 1958.

TAXONOMIC RELATIONSHIPS OF *NULLIBROTHEAS*. *Nullibrotheas allenii* was first placed within the genus *Scorpius* by Wood in 1863 where it remained until 1887 at which time George Marx placed it within the chactid genus *Broteas*. Since this species has been relatively unstudied it has essentially remained placed in the genus *Broteas* and family Chactidae until now. However, Banks (1910) apparently realized that '*allenii*' was not properly placed within the genus *Broteas* because he assigned this species to the genus *Broteochactas* thus retaining it within the family Chactidae. Banks' generic assignment was, however, not followed by others working with North American scorpions.

It is interesting that European workers did not agree with the systematic placement of '*allenii*' by American workers. In 1879, Karsch studied a juvenile specimen of *N. allenii* and named it *Uroctonus privus*, thus placing it within the family Vaejovidae. Later Kraepelin (1899), considered *U. privus* (a junior synonym of *N. allenii*) to be a junior synonym of *Uroctonus mordax*, thus also retaining *N. allenii* within the family Vaejovidae. Kraepelin (1899) did not see the relationship between "*Broteas allenii*" and *Uroctonus privus*, but he did indicate that he believed "*B. allenii*" to be a good species, and doubted that it should be placed in the Chactidae.

The family placement of the genus *Nullibrotheas* is made somewhat difficult by the obscure relationship between the families Chactidae and Vaejovidae. The primary characteristic that has been used to differentiate these two families is the presence of two lateral ocelli at each anterolateral corner of the carapace in the Chactidae. The family Vaejovidae is contrasted by having three or more lateral ocelli at each anterolateral corner of the carapace. Numbers of lateral ocelli are not satisfactory criteria alone for placement of scorpions within a family. Several species which clearly belong to families other than the Chactidae have secondarily lost lateral ocelli. For example, in the Diplocentridae several species belonging to the *Didymocentrus* group show only two lateral ocelli at each anterolateral corner of the carapace. These were even considered by Stahnke (1968) to represent a new diplocentrid genus which he called *Bioculus*. Gertsch (1972) has found several species of *Vaejovis* and *Uroctonus* which either have external signs of the third lateral ocellus completely absent or in an obsolescent state. Actually, most species of *Vaejovis* and *Uroctonus* have the third lateral ocellus showing signs of becoming reduced in size or approaching obsolescence.

Nullibrotheas allenii clearly does not belong in the genus *Broteas* because it has the openings to the book lungs completely circular rather than linear, and the last tarsomere of the walking legs has one row of ventral hairs (not two parallel rows of spine-like hairs). *Nullibrotheas allenii* also clearly does not belong in the genus *Broteochactas* because it has six trichobothria in a posterior row on the ventral surface of the pedipalp brachium (not seven such trichobothria), and also because the walking legs have the last tarsomere with one row of ventral hairs (not with abundant irregular hairs).

Study of the lateral ocelli of *Nullibrotheas allenii* reveals two distinct eyes at each anterolateral corner of the carapace in some specimens. However, individuals usually show evidence of a third reduced or degenerate ocellus. This line of evidence indicates that this genus should be placed within the family Vaejovidae. Furthermore, in other characteristics it appears somewhat related to the genera *Uroctonus* and *Vaejovis* (both members of the family Vaejovidae).

Nullibrotheas can be clearly distinguished from *Vaejovis* and *Uroctonus* in that it has the ventral surface of the pedipalp tibia (brachium) with six trichobothria in a posterior row (not with two or three such trichobothria) and has minute, round openings to the book lungs (not slit-like or oval).

Considering all the morphological evidence available it appears that *Nullibrotheas* has no known close living relatives, but that it is more closely related to the vaejovid genera *Uroctonus* and *Vaejovis* than to any other living ones known. *Nullibrotheas* is therefore here considered to be a member of the family Vaejovidae.

Key to the North American genera of the family Vaejovidae

1. Book lung openings round .... *Nullibrotheas*, new genus
   Book lung openings not round, but oval or elongate 2
2. Metasoma with single, unpaired, inferior median keel on segments I to IV .... genus *Syntropis*
   Metasoma with inferior median keels of segments I to IV paired or obsolescent 3
3. Lateral ocelli four per group; pectines with middle lamellae angular and not circular .... genus *Anuroctonus*
   Lateral eyes three or fewer per group; pectines with middle lamellae subcircular 4
4. Inferior margin of movable cheliceral finger with one long, dark, conspicuous tooth; pedipalps with ventral surface of brachium with over 20 trichobothria .... genus *Hadrurus*
   Inferior margin of movable cheliceral finger with small teeth, minor denticles, denticle-like crenulation, or completely lacking denticles; pedipalps with ventral surface of brachium with two or three trichobothria along posterior border 5
5. Pectines with middle lamellae usually composed of 9 or fewer circular sclerites; openings to book lungs usually oval or long oval in shape and generally with length less than three times width; pedipalp with ratio of palm width to palm depth generally greater than 1.05; pedipalps with ventral surface of brachium with three trichobothria .... genus *Uroctonus*
   Pectines with middle lamellae usually composed of 10 or more circular sclerites; openings to book lungs usually elongate or slit-like and generally with length greater than three times width; pedipalp with ratio of palm width to palm depth generally less than 1.05; pedipalps with ventral surface of brachium always with 2 trichobothria (never with three) 6
6. Chelicerae with inferior margin of movable finger with one or several small denticles or crenulations .... genus *Paruroctonus*
   Chelicerae with inferior margin of movable finger smooth and completely lacking crenulations .... genus *Vaejovis*

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